FIRE AND FAUNA IN THE NORTHERN JARRAH FOREST OF WESTERN AUSTRALIA

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When Europeans first settled in the South-west, much of the forest was composed of mature or overmature virgin stands. This forest was recorded as having a relatively open and clear forest floor which carried little fuel on the ground to feed large, hot fires. It is fairly certain that many of the frequent fires that did occur, probably lit by natives or lightning, burnt quietly and slowly through the forest.

When early uncontrolled harvesting of our forest began, this situation changed drastically. Rapid and excessive exploitation removed many of the larger trees which created extensive gaps in the canopy. These opening permitted the buildup and excessive growth of scrub and understorey species. Logging debris such as discarded logs, branches, leaves and bark accumulated on the ground and greatly added to the total amount of fuel. In their efforts to deal with this problem, the Forests Department at first attempted to exclude all fires from the forest. This resulted in a situation that made fire control operations extremely difficult at best. It was not surprising that very intense, uncontrollable wildfires occurred in State Forest, the 1961 Dwellingup fire being a prime example.

To reduce the risk of wildfires and facilitate fire control operations, the Forests Department implemented a programme of prescribed burning. This burning involves the use of low intensity, mild fires within predetermined boundaries to remove or reduce the fuel hazard. Such burning is now done throughout the forest area on a rotation in excess of five years.

We know from research studies and observation that the forest flora in the South-west is associated with and dependent upon fire. That is, the vegetation has developed in a fire environment and has adapted to it over thousands of years. We also know that the forest flora provides suitable habitat for a large number of mammals, birds and reptiles. What we did not know until recently, however, is how fire, both wildfires and prescribed burning, affected our forest fauna. The Department's practice of prescribed burning has been criticised in the past by concerned individuals and groups. This criticism partly arises from the belief that burning causes widespread destruction of fauna. Until several years ago, there was little evidence available in Australia to either support or refute this belief.

In 1971, the Department started a research programme to investigate the effects of burning on our forest fauna. Specifically, the objectives of this research in the jarrah *(Eucalyptus marginata)* forest type near Dwellingup are as follows:

(1). To determine the distribution of small mammals within the northern jarrah forest in relation to such factors as understorey vegetation, topography, time of year and burning history of the areas surveyed.

(2). To study in detail the effects of prescribed burning in swamps on the ecology of certain mammals, including the Yellow-footed Marsupial Mouse or Mardo *(Antechinus flavipes)*, the Short-nosed Bandicoot *(Isoodon obesulus)*, the Quokka *(Setonix brachyurus)*, the introduced Ship Rat *(Rattus rattus)* and the common House Mouse *(Mus musculus)*.

(3). To study the effects of both prescribed burning and total fire exclusion on the ecology of small mammals in upland forest areas.

In a similar research programme at Manjimup, the Department is investigating the effects of burning on the Southern Bush-rat *(Rattus fuscipes)* and the Brush-tailed Bettong or Woylie *(Bettongia penicillata)*.

Survey techniques used in the Dwellingup survey include spotlighting, habitat examination and live-trapping. Live-trapping has been the main basis for assessing fire effects on mammals. Selected study areas are trapped prior to burning and all mammals captured are measured, ear-tagged and released for future identification. Following burning, these study areas are retrapped periodically to determine what effects burning has had on mammal numbers, distribution and breeding cycles. An assessment of the vegetation is also made prior

to and following burning so that it is possible to relate any changes in understorey composition or structure to fluctuations in mammal numbers and changes in behaviour patterns.

Since the fauna survey began, 23 species of mammals have been recorded in State Forest near Dwellingup (Appendix 1). Results of the exploratory phase of the study indicate that the denser vegetation associated with swamps, in contrast to the more upland forest, supports both greater numbers and a wider range of species. Except for the larger macropods such as the Western Grey Kangaroo *(Macropus fuliginosus)* and Black-gloved Wallaby *(Macropus irma)* and the occasional small marsupial, upland jarrah forest is relatively low in mammal numbers.

Population data over a 12 month period is available for the Mardo and the introduced Ship Rat in three swamps near Dwellingup that were aerial burnt in the spring of 1971. Trapping returns for all three areas show a sharp decline in rat numbers following burning, while Mardo numbers have increased (Table 1).

Table 1.—THE EFFECT OF PRESCRIBED BURNING* ON NUMBERS OF TWO MAMMAL SPECIES IN SWAMP HABITAT NEAR DWELLINGUP.

	Number of Trap Nights	Number of different Individuals captured	
		Ship Rat *(Rattus rattus)*	Mardo *(Antechinus flavipes)*
Pre-burn	1,496	16	2
Post-burn	1,895	6	21

*Prescribed burning rarely results in over 60% of any one unit being burnt. There are always irregular patches of forest and swamp that do not burn due to limited fuel, natural firebreaks, etc. Thus, mammals are able to retreat to these areas for refuge during any burning operations.

The Ship Rat displays a marked preference for dense vegetation and this was removed by the fire, hence the subsequent decline in numbers following burning. The increase in numbers of the Mardo is more difficult to explain, as its breeding period occurred about 6 weeks prior to the burn.† Apart from any natural population expansion, this increase in numbers may indicate that some food sources such as insects become more plentiful or available following burning. If this occurred, then individuals in adjacent unburnt swamp may have been attracted to the burnt study areas.

†The W.A. race of the Yellow-footed Marsupial Mouse or Mardo *(Antechinus flavipes leucogaster)* mates in late August or early September and the young are born approximately 3½ to 4 weeks later. Any young produced prior to the burn would not be trapable until early summer, and are thus not reflected in pre-burn numbers.

In each of the swamps studied, some of the mammals captured prior to the fire were retrapped in good condition following the burn. A post-burn search of the areas produced no dead or damaged mammals. Thus at least for these two species, there is no evidence to support the belief that burning is destructive. To the contrary, prescribed burning appears to favour the Mardo. There is no evidence that the Ship Rat will not also recolonise these burnt swamp areas in several years time when the dense scrub understorey reappears.

A study of mammal numbers and distribution is also being conducted in an upland forest compartment that has had all fire excluded from it for over 40 years. Results from live-trapping and visual surveys have demonstrated that this area does not support higher numbers or more species of mammals than do similar adjacent forest blocks that have been burnt periodically. From vegetation assessments in this unburnt block, we know that both the number of plant species and the amount of live ground cover is less than in the adjacent forest that is regularly burnt. This finding suggests that prescribed burning is a useful management technique for providing the vegetational diversity that many of our species of mammals seem to require.

CONCLUSIONS

Interim results from 18 months of a fauna survey in the northern jarrah forest indicate that:

(1). The majority of small mammals in the northern jarrah forest near Dwellingup are concentrated in swamps or other areas of dense vegetation. Except for the larger macropods and a limited number of smaller mammals, upland areas of jarrah are relatively lacking in signs of mammal activity.

(2). Although fire certainly plays a major role in the ecology of small mammals, prescribed burning has not yet been found to be detrimental to any of the native species studied to date.

(3). An area of upland jarrah forest that has had all fire excluded from it for 40 years does not support a higher number or greater range of mammal species than do similar areas that have been regularly burnt.

The long range goal of this survey is to ensure that the Department maintains adequate areas of suitable habitat for all native mammal species resident in State Forest. Possibly this end can be achieved by a system of deferred rotational burning of particular habitat types such as swamps. There is no apparent reason why such a system should conflict with the major objective of the prescribed burning programme, which is fuel reduction to a level which will facilitate suppression of wildfires in summer conditions.

As a result of the Department's investigations, a large area of State Forest near the Tone River some 30 miles east of Manjimup has been set aside as an intensive management unit for fauna. This unit contains 28 species of mammals, making it the richest fauna area so far recorded in the South-west. Research of the type described in this article is being carried out within the unit to ensure the best possible management of the fauna resource in the future.

APPENDIX 1

The following is a check list of mammals recorded in State Forest near Dwellingup during the fauna survey*:

Native Species

Common name	Scientific name
Western Grey Kangaroo	*Macropus fuliginosus*
Black-gloved Wallaby	*Macropus irma*
Quokka	*Setonix brachyurus*
Brush-tailed Possum	*Trichosurus vulpecula*
South-western Pigmy Possum	*Cercartetus concinnus*
Short-nosed Bandicoot	*Isoodon obesulus*
Western Native Cat	*Dasyurus geoffroii*
Brush-tailed Phascogale	*Phascogale tapoatafa*
Yellow-footed Marsupial Mouse	*Antechinus flavipes*
Common Dunnart	*Sminthopsis murina*
Banded Anteater	*Myrmecobius fasciatus*
Water Rat	*Hydromys chrysogaster*
Spiny Anteater	*Tachyglossus aculeatus*
Greater Long-eared Bat	*Nyctophilus timoriensis*
Lesser Long-eared Bat	*Nyctophilus geoffroyi*
Little Bat	*Eptesicus pumilus*

Introduced Species

Common House Mouse	*Mus musculus*
Ship or Black Rat	*Rattus rattus*
Feral Cat	*Felis catus*
Feral Pig	*Sus scrofa*
European Rabbit	*Oryctolagus cuniculus*
Dingo	*Canis familiaris*
Fox	*Vulpes vulpes*

*There have been unconfirmed reports of other mammals near Dwellingup. These include the Feral Horse *(Equus caballus)*, the Brush-tailed Bettong *(Bettongia penicillata)* and an unidentified species of Native or Hopping Mouse.